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MINERAL RESOURCES OF THE DOÑA ANA MOUNTAINS MINING DISTRICT, DOÑA ANA COUNTY, NEW MEXICO

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Abstract—A small amount of copper and approximately 100 ounces of gold and 5000 ounces of silver worth approximately $5000 have been produced from the Doña Ana Mountains mining district from volcanic-epithermal vein deposits discovered about 1900. These deposits are associated with the Doña Ana caldera, which formed at about 36 Ma. Some of New Mexico's largest gold and silver deposits are volcanic-epithermal vein deposits. Marble and tactite outcrops are locally common in the Doña Ana Mountains, suggesting potential for lead-zinc and gold skarn and/or carbonate-hosted replacement deposits at depth. The presence of volcanic-epithermal veins and mineralized marble in the Doña Ana Mountains mining district indicates that additional exploration is needed, even though the caldera is a relatively small hydrothermal system.

INTRODUCTION

The Doña Ana Mountains mining district is in the Doña Ana Mountains east of Radium Springs, New Mexico (Fig. 1). The known mineral deposits consist of volcanic-epithermal vein and marble deposits that were discovered about 1900. Volcanic-epithermal vein deposits are metallic vein deposits, predominantly gold, silver, copper, lead, and zinc, that are formed by ascending waters at shallow to moderate depths (<4500 ft), low to moderate temperatures (50–300°C), and typically associated with intrusive and/or volcanic rocks. Some of New Mexico's largest gold and silver deposits are volcanic-epithermal vein deposits (McLemore, 1996, 2001, 2017). Marble and tactite outcrops are locally common in the Doña Ana Mountains, suggesting potential for lead-zinc and gold skarn and/or carbonate-hosted replacement deposits. The purposes of this report are to describe the mineral deposits in the Doña Ana Mountains district and summarize the economic mineral potential of the Doña Ana Mountains deposits.

LOCATION AND MINING HISTORY

Production occurred from mineral deposits in the Doña Ana Mountains during the early 1900s. A small amount of copper and approximately 100 oz of gold and 5000 oz of silver worth approximately $5000 have been produced from the district (Table 1; North and McLemore, 1986; McLemore, 2017). Marble has been quarried for local crushed stone, including rip-rap, but production records are not available.

GEOLOGY

Rocks in the Doña Ana Mountains range in age from Permian through Recent (Seager et al., 1976). Permian through Eocene sedimentary rocks have been intruded by Eocene andesite and Oligocene monzonite and rhyolite and monzonite dikes. The eruption of the 762-m-thick Doña Ana Rhyolite (ash-flow tuff) initiated caldera collapse at about 36 Ma (Askin et al., 2017). The Doña Ana caldera is approximately 11–12.8 km in diameter and was filled by rhyolite flows, ash-flow tuffs, domes, and breccias. The Doña Ana mining district is along the northern edge of the caldera. Late Tertiary uplift and westward tilting have exposed the mountain range (Seager et al., 1976). Regional geophysical data shows a gravity high encircling the northwest side of the caldera, and a magnetic high that is probably caused by an intrusion within the caldera (Bartsch-Win-

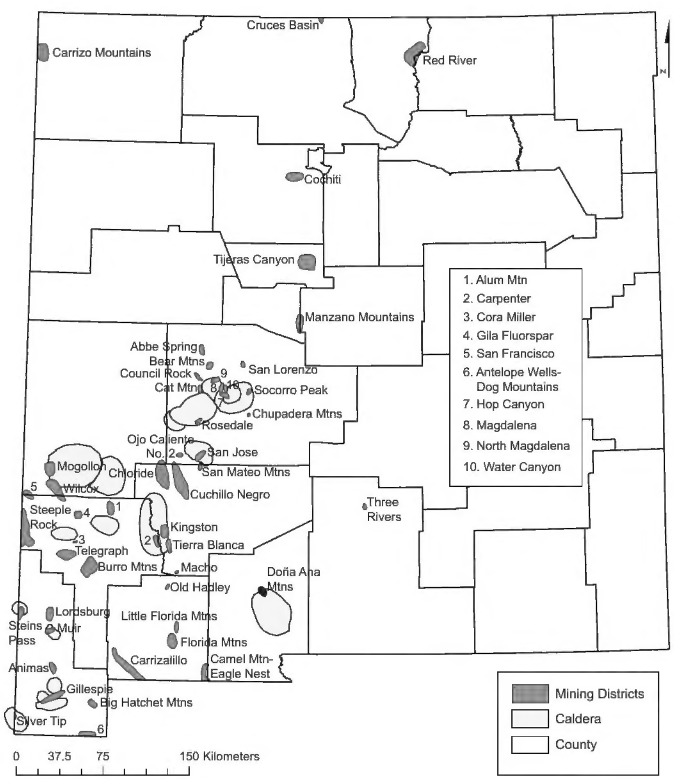

FIGURE 1. Volcanic-epithermal districts in New Mexico (modified from McLemore and Lueth, 2017).

TABLE 1. Mines and prospects in the Doña Ana Mountains mining district. Mine Id Numbers are from the New Mexico Mines database (McLemore et al., 2005a, b). Latitude and longitude are in decimal degrees in NAD27.

Mine Id	Mine name	Township	Range	Section	Latitude	Longitude	Commodities produced	Commodities present, not produced	Development
NMDA0025	Piedra Blanca	21S	1E	15	32.47941	-106.82272		Au, Mn, Ag	pit
NMDA0026	unknown	21S	1E	15	32.48495	-106.83648		Au, Ag, Zn	pits
NMDA0027	unknown	21S	1E	10, 15	32.48928	-106.82336	marble	Pb, Cu	pits
NMDA0028	East Dagger Flat	21S	2E	20	32.4724	-106.76129	Au, Cu, Ag		shaft, shaft, pit, cut
NMDA0029	unknown	21S	1E	15	32.48211	-106.82698		Au, Ag, Mn	shaft, pits
NMDA0328	unknown	21S	1E	11	32.49819	-106.80763		Au, Ag, Mn	pit
NMDA0329	unknown	21S	1E	11	32.49819	-106.80763		Au, Ag, Mn	pit
NMDA0330	unknown	21S	1E	16	32.48461	-106.83925		Au, Ag, Mn	pit
NMDA0331	unknown	21S	1E	16	32.48613	-106.84006		Au, Ag, Mn	pit
NMDA0332	unknown	21S	1E	16	32.4883	-106.83748		Au, Ag, Mn	pit
NMDA0333	unknown	21S	1E	10	32.48991	-106.82262		Au, Ag, Mn	pit
NMDA0334	unknown	21S	1E	14	32.48448	-106.81117		Au, Ag, Mn	pit

kler, 1997; Kucks et al., 2001). More details on the geology of the caldera are elsewhere in this guidebook.

VOLCANIC-EPITHERMAL DEPOSITS

Volcanic-epithermal mineral deposits are found in many districts in New Mexico (Fig. 1) in structurally complex tectonic settings that provide an excellent plumbing system necessary for circulation of hydrothermal fluids such as Steeple Rock, Mogollon, Chloride, and others (Fig. 1). Lindgren (1933) defined the term *epithermal* to include a broad range of deposits that formed by ascending waters at shallow to moderate depths (<1372 m), low to moderate temperatures (50–200°C), and which are typically associated with intrusive and/or volcanic rocks. It is now generally accepted that epithermal deposits were formed at slightly higher temperatures (50–300°C) and relatively low pressures (a few hundred bars) based on fluid inclusion and isotopic data (Simmons et al., 2005). White (1955, 1981) established the now-recognized association between epithermal mineral deposits and active geothermal or hot springs systems. Subsequent work by Henley (1985) and associates (Henley and Brown, 1985) in New Zealand, and many other researchers elsewhere, confirmed this association. However, there are many small hot spring systems with no known associated gold or base metals. The difficulty remains in identifying paleo-geothermal systems that contain economic concentrations of gold and/or base metals. The volcanic-epithermal vein deposits in New Mexico are restricted in this paper to veins associated with Oligocene to Miocene volcanic fields and calderas (Cox and Singer, 1986). Many volcanic-epithermal deposits in New Mexico occur along the margins of calderas (Fig. 1; Rytuba, 1981; Elston, 1984, 1994; McLemore, 1996; McLemore and Lueth, 2017), although other structurally complex volcanic settings, such as silicic domes and andesitic stratovolcanoes, are not uncommon for these deposits. It is important to note that not all calderas are mineralized. Only a few calderas in New Mexico contain economic epithermal mineral deposits (McLemore, 1996), nonetheless most known epithermal deposits in New Mexico are restricted to volcanic terranes and areas immediately adjacent to volcanic fields.

MINERAL DEPOSITS

Several mines and prospects are found in the Doña Ana Mountains mining district. The Piedra Blanca prospect (Fig. 2) consists of thin quartz veins along a 1.2-m-wide rhyolite dike which strikes N80°W and dips 85°N. The dike intruded the Cleofas Andesite (Seager et al., 1976). Three shafts 24.3 m, 7.6 m, and 15.2 m deep and several shallow pits, have exposed the deposit (Dunham, 1935; Seager et al., 1976). The vein is less than 0.6 m wide and consists of quartz, iron oxides, manganese oxides, chlorite, calcite, and pyrite (Dunham, 1935; Farnham, 1961; Seager et al., 1976). Silicification of the rhyolite and andesite is pervasive (Seager et al., 1976). Two separate assays of a high-grade ore shoot in 1913 indicated 13.5 oz/short ton (422 ppm) Au, 1835 oz/short ton (57,300 ppm) Ag and 13.6 oz/short ton (425 ppm) Au, 1526 oz/short ton (47,700 ppm) Ag (Dunham, 1935). Assays of samples collected for this report are in Table 2 and are much lower than previously reported, mostly because they are samples of waste rock piles. Another occurrence, similar to the Piedra Blanca prospect, is found along a north-trending dike. A 6.1-m shaft and pits expose the thin quartz veins containing traces of pyrite.

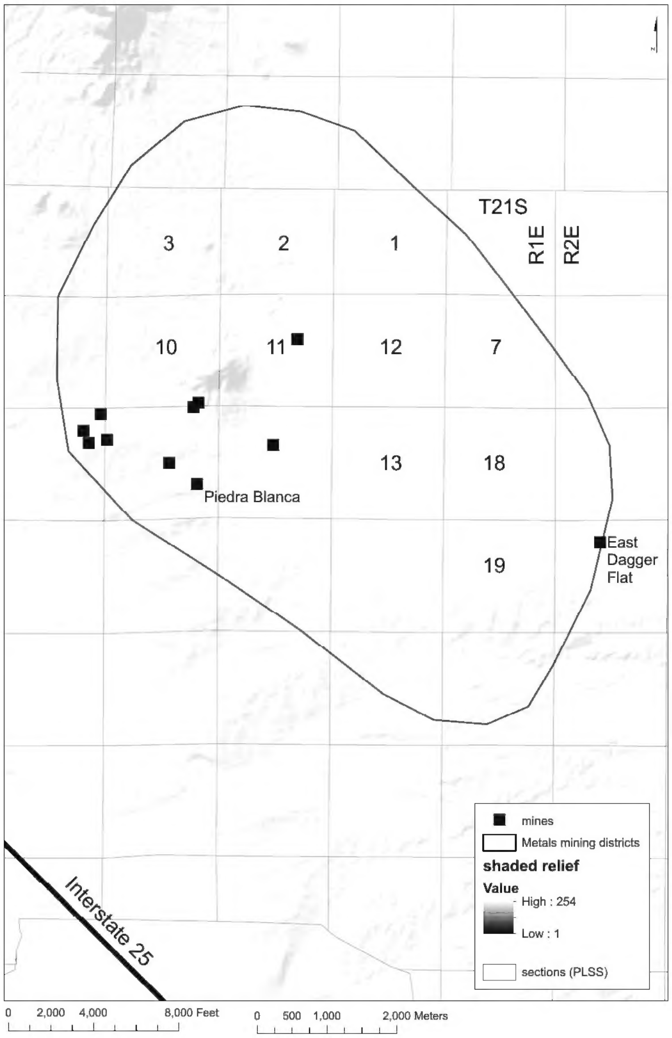

FIGURE 2. Mines and prospects in the Doña Ana Mountains mining district. See Figure 1 for location of district in New Mexico.

Another vein is found near East Dagger Flat and is exposed by two shafts, 15.2 m and 7.6 m deep, a cut and shallow pit (V. T. McLemore, unpublished field notes May 28, 1995; Seager et al., 1976). Quartz and malachite occur along fractures in the Cleofas Andesite. Several prospects northwest of Doña Ana Peak have exposed manganese veins (Table 2).

Marble occurs in sec. 10 and 15, T21S, R1E and tactite crops out in sec. 15 and 16, T21S, R1E. Marble has been quarried for local use as rip-rap and road fill. The marble varies in color from white to pink, but is highly fractured and contains impurities and is not suitable for use as large blocks of dimension stone. Traces of iron oxides, pyrite, and chalcopyrite are found, but the metal potential is low (Table 2). However, one sample assayed 6.12 oz/short ton (191 ppm) Ag (DM6, Table 2). The tactite consists of fine-grained garnet and iron oxides with traces of pyrite. The marble and tactite are similar in appearance to mineralized skarns elsewhere in southwestern New Mexico (McLemore et al., 1996).

MINERAL-RESOURCE POTENTIAL

Most of the exploration effort in Doña Ana County has been spent in the Organ Mountains. However, the presence of volcanic-epithermal veins and marble in the Doña Ana Mountains mining district indicates that additional exploration is needed, even though the caldera is a relatively small hydrothermal system. The deposits in the Doña Ana Mountains are similar to those found in the Macho mining district in Sierra County, where drilling indicated additional veins at depth as well as carbonate-hosted silver-lead-zinc deposits in the Fusselman Dolomite, which is 1097–1128 m deep in the Macho district (McLemore, 2012). Similar mineralization is believed to occur in the Doña Ana Mountains.

TABLE 2. Chemical analyses of samples collected from the Doña Ana Mountains mining district (from McLemore et al., 1996). Analyses were by the New Mexico Bureau of Mines and Mineral Resources Chemical Laboratory in 1996.

Sample No.	Mine Id	Ag oz/ton (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Comments
DM1	NMDA0028		2100	12	61	sample of dump
DM2	NMDA0028	<0.02 (0.625)	1500	<50	120	sample of dump
DM3	NMDA0028	<0.02 (0.625)	120	<50	84	sample of dump
DM4	NMDA0028	<0.02 (0.625)	120	<50	84	sample of dump
DM5	NMDA0025	<0.02 (0.625)	<50	75	150	sample of dump
DM6	NMDA0027	6.12 (191)	<50	63	87	sample of dump
DM7	NMDA0026	<0.02 (0.625)	50	<50	110	Sample of tactite
DM8	NMDA0026	<0.02 (0.625)	63	<50	330	1 m sample of tactite
DM9	NMDA0029	<0.02 (0.625)	<50	67	110	sample of dump

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